**Spontaneity & ΔH**

A spontaneous reaction is one that tends to proceed to completion once it starts.

e.g. a piece of paper continues to burn once it is lit.

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| Exothermic rxn | Endothermic rxn |
| ΔH \_\_\_\_  🡪 generally are \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ rxn  e.g. ΔH1 = -10 kJ ΔH2 = -100 kJ  The reaction with \_\_\_\_\_\_\_\_\_\_ will give off more heat and have a greater driving force to make it go. | ΔH \_\_\_\_  🡪 generally are \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ rxn  e.g. boiling water requires continual input of energy  decomposition requires continual input of energy HgO ----> Hg + O2 |

Two Properties of ΔH

1. If a chemical equation is \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ the sign of ΔH is also\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_.

eg. H2(g) + ½ O2(g) -----> H2O(g) ΔH = -241.8 kJ

reverse equation:

2. The size of ΔH varies with the \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ of reactant.

Consider: 6C(s) + 3H2(g) -----> C6H6(g) ΔH = 82 kJ

This thermochemical equation says all of the following:

i) 82 kJ heat are used up when 1 mole C6H6 is made.

ii) 82 kJ heat are used up when 6 moles C are used up.

iii) 82 kJ heat are used up when 3 moles H2 are used up.

If now the equation is to be rewritten to show 1 mole of C, this would be done by \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ .

The value for ΔH is then similarly \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

C(s) + H2(g) -----> C6H6(g) ΔH =

Q. Rewrite the equation for 1 mole H2:

A.

Q. Rewrite the following equation for 1 mole N2(g):

½ N2(g) + 3/2 H2(g) -----> NH3(g) ΔH = -45 kJ

A.

Q. Rewrite the following equation for 1 mole O2(g):

3H2SO4(l) -----> 3SO2(g) + 3H2O(g) + 3/2 O2(g) ΔH = 815 kJ

A.

Using the values stated above, determine the heat of released when 125 g of hydrogen reacts with excess nitrogen to form ammonia. (1.86 MJ)

**Further practice:**

1. When phosphorus burns in air, it produces phosphorus (V) oxide: P4 (s) + 5 O2 (g) → P4O10 (s) ∆H = -2940 kJ

What is the ∆H for the following reactions: P4O10 (s) → P4 (s) + 5 O2(g)

1. Carbon disulfide burns in air in the following reaction: CS2 (l) + 3 O2 (g) → CO2 (g) + 2 SO2 (g) ∆H = -1075 kJ What is the ∆H for the following reactions: ½ CS2 (l) + 3/2 O2 (g) → ½ CO2 (g) + 2 SO2 (g)